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# NASA HQ/Science Mission Directorate Update to the Sounding Rocket Working Group

July 18, 2012



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# Science Mission Directorate Update

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## Organizational

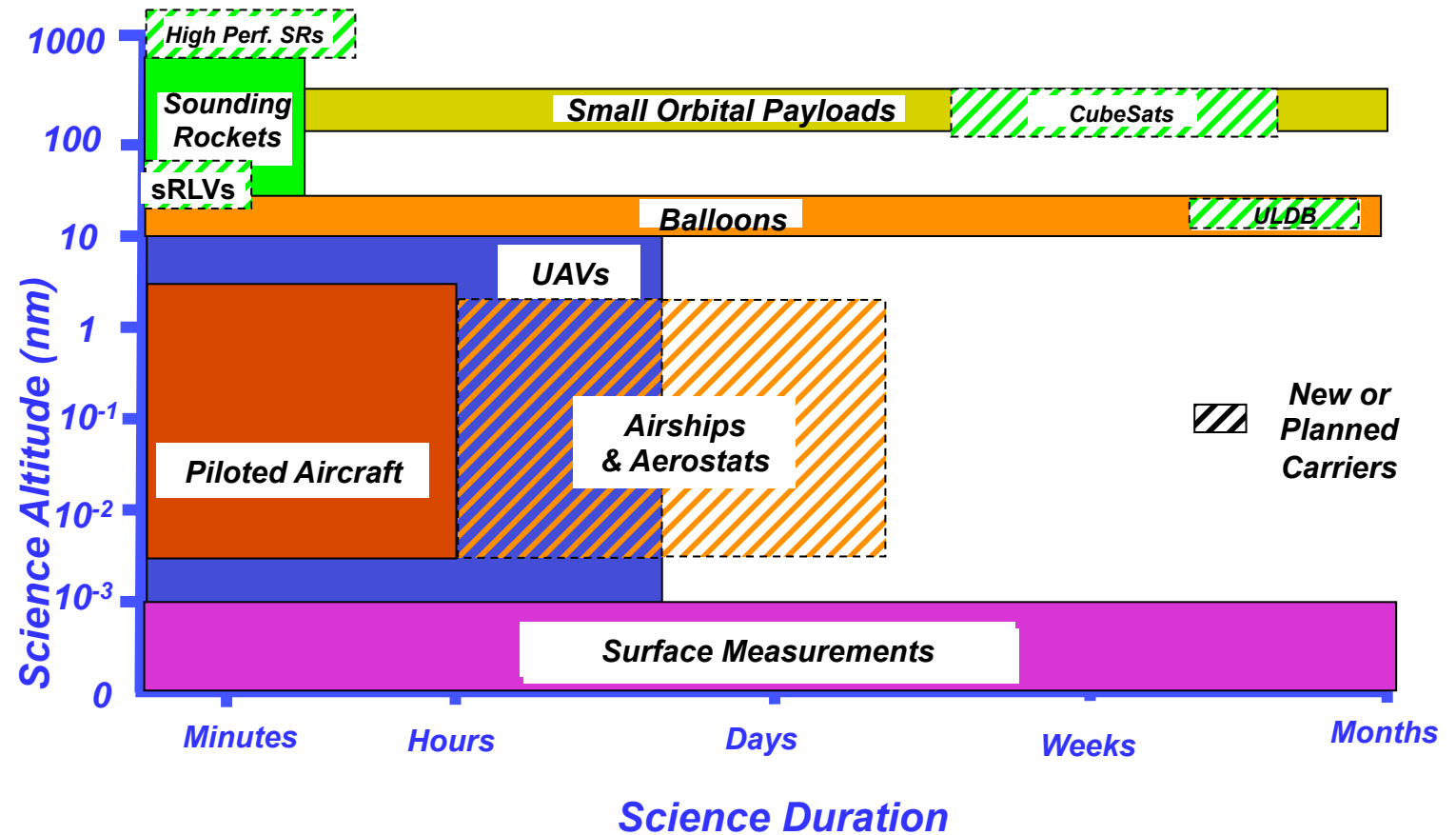
- Chief Scientist position vacant (P. Hertz moved to Astrophysics Division Director, Colleen Hartman to GSFC Deputy Center Director)

## Recent & Upcoming SMD Events

- NuSTAR Launch – June 13
- Earth Venture-2 CYGNSS (8 microsatellite constellation) selection announcement - June 18
- MSL “Curiosity” rover landing – August 5
- RBSP Launch – August 23
- BARREL Deployment – December 2012 – January 2013
- Landsat Data Continuity Mission Launch – January 2013
- IRIS Launch – June 2013



# Suborbital Altitude versus Duration





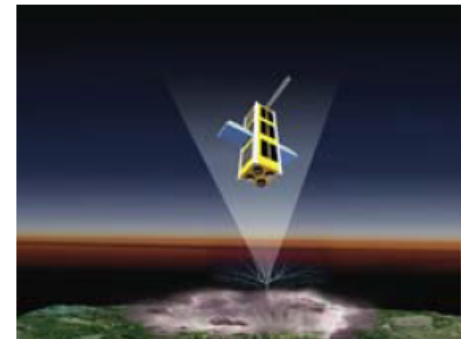
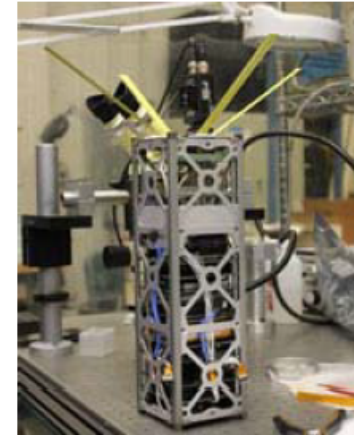
## SMD Suborbital Core Vehicle Capabilities

Company	Vehicle	Operational Date	Launch Site	Payload Weight	Altitude	Duration	ROM Vehicle Mission Cost	\$/t on station
<b>NASA BPO</b>	Conventional Balloon	Fully Operational	Texas, New Mexico, Australia	20 – 2300 kg	20 – 50 km	6-30 hours	\$300K	\$10-50K/hr
<b>NASA BPO</b>	LDB Balloon	Fully Operational	Sweden, Antarctica * New Zealand	20 - 2000 kg	33 - 38 km	6 – 40+ days	\$300K	\$8-50K/day
<b>NASA BPO</b>	ULDB Balloon	2014	Antarctica * New Zealand	20 - 2000 kg	33 km (est)	60 – 100 days	\$1500K	\$15-25K/day
<b>NASA SRPO</b>	Improved Orion	Fully Operational	Global	25 - 80 kg	50-100 km	3 minutes	\$61K	\$23K/min
<b>NASA SRPO</b>	Terrier-Improved Orion	Fully Operational	Global	45 -180 kg	100-200 km	6 minutes	\$100K	\$19K/min
<b>NASA SRPO</b>	Black Brant IX	Fully Operational	Global	91 - 272 kg	200-400 km	10 minutes	\$900K	\$100K/min
<b>NASA SRPO</b>	Black Brant X	Fully Operational	Global	79 - 227 kg	400-1300 km	20 minutes	\$1300K	\$83K/min
<b>NASA SRPO</b>	Black Brant XI	Fully Operational	Global	91 – 272 kg	300- 650km	12 minutes	\$1000K	\$100K/min
<b>NASA SRPO</b>	Black Brant XII	Fully Operational	Global	68 – 227 kg	500- 1500km	22 minutes	\$1400K	\$77K/min
<b>NASA ASP</b>	Global Hawk	Fully Operational	Global	680 kg	20 Km	31 Hours	Access fee \$60K/week or \$250K/month \$1.8K/Flt hour up to 150hrs/month	\$8.1K/flt hr up to 150 hrs for a full month of access
<b>NASA ASP</b>	ER-2	Fully Operational	Global	1,315 kg	21 km	12 Hours	\$3.5K	\$.3K/flt hr
<b>NASA ASP</b>	DC-8	Fully Operational	Global	13,600 kg	13 Km	12 Hours	\$6.5K	\$.5K/flt hr
<b>NASA ASP</b>	P-3B	Fully Operational	Global	6670 kg	10 Km	14 Hours	\$3.5K	\$.3K/flt hr
<b>NASA ASP</b>	GIII/UAVSAR	Fully Operational	Global	N/A	13 Km	7 Hours	\$3.0K	\$.4K/flt hr



# CubeSats

- NASA provides a reasonably priced/frequent access to space for CubeSats on NASA ELVs or commercial launches.
- CubeSats provide cost-effective platforms for development, and launches are becoming increasingly more available.
- Increase participation in STEM disciplines.  
Sponsor early Innovation, Do relevant science
- CubeSats are missions at a fraction of the cost of larger space craft missions
- Conduct Science, Technology, and STEM activities
- NASA Offers annual solicitation - CubeSat Launch Initiative (CSLI)
  - Excess capacity on most NASA ELVs
  - Rule #1: Cause no harm to the primary.
- PPOD Standards
  - Use 1 U and 3 U designs
  - 6U designs out there.
- Since 2009, NASA has selected 65 CubeSats





## NASA Flight Opportunities Program/ Commercial Suborbital Vehicles

NASA/OCT selected (2011) seven companies to integrate and fly technology payloads on commercial suborbital reusable platforms that carry payloads near the boundary of space.

(<https://flightopportunities.nasa.gov/>)

The selected companies are:

- Armadillo Aerospace, Heath, Texas
- Near Space Corp., Tillamook, Ore.
- Masten Space Systems, Mojave, Calif.
- Up Aerospace Inc., Highlands Ranch, Colo.
- Virgin Galactic, Mojave, Calif.
- Whittinghill Aerospace LLC, Camarillo, Calif.
- XCOR, Mojave, Calif.

As part of NASA's Flight Opportunities Program, each successful vendor will receive an indefinite-delivery, indefinite-quantity contract. These two-year contracts, worth a combined total of \$10 million, will allow NASA to draw from a pool of commercial space companies to deliver payload integration and flight services. The flights will carry a variety of payloads to help meet the agency's research and technology needs.



The OCT/Flight Opportunities Program is managed at NASA's Dryden Flight Research Center in Edwards, Calif. For more information on the program, visit: <http://flightopportunities.nasa.gov>





# OCT Suborbital Vehicle Capabilities

Company	Vehicle	Operational Date	Launch Site	Payload Mass	Altitude	Duration	ROM Vehicle Mission Cost	\$/t on station
<b>Armadillo Aerospace</b>	STIG-A/B	Under development	Spaceport America, NM	~ 25 kg	~100 km	3-5 minutes		
<b>Blue Origin</b>	New Shepard	Under development	West Texas Launch Site	11-22 kg	100 km (est)	3-5 minutes		
<b>Masten</b>	Xaero	2012	Mojave Spaceport, CCAS, FL	10-40 kg	30 km	5-6 minutes of microgravity		
<b>Masten</b>	Xogdor	Under development	Mojave Spaceport	TBA	100 km	TBA		
<b>Near Space Corp</b>	Balloon	2012	Tillamook, Ore	10 kg	35km	Up to 6 hours		
<b>UP Aerospace</b>	SpaceLoft-6 Rocket	2012	Spaceport America, NM	36 kg	115 km	4-6 minutes TFT: 13 mins		
<b>Virgin Galactic</b>	SpaceShip 2	TBD- powered test flights underway	Spaceport America, NM	20 -600 kg	15 – 100km	3-5 minutes of microgravity		
<b>Whittinghill Aerospace</b>	MCLV	Under development						
<b>XCOR</b>	LYNX MARK I/II/III	2Q 2013/14	Mojave Spaceport	20 -280Kgs	200-300 Km	60-200 sec		

OCT/ Commercial Suborbital Vehicles



## SMD Suborbital Programs – FY 12 Activity

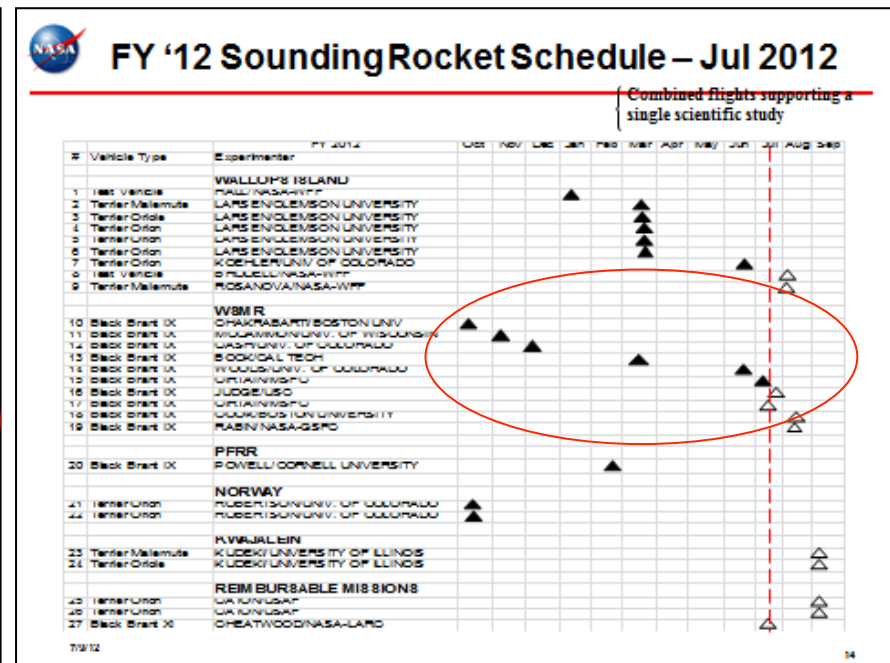
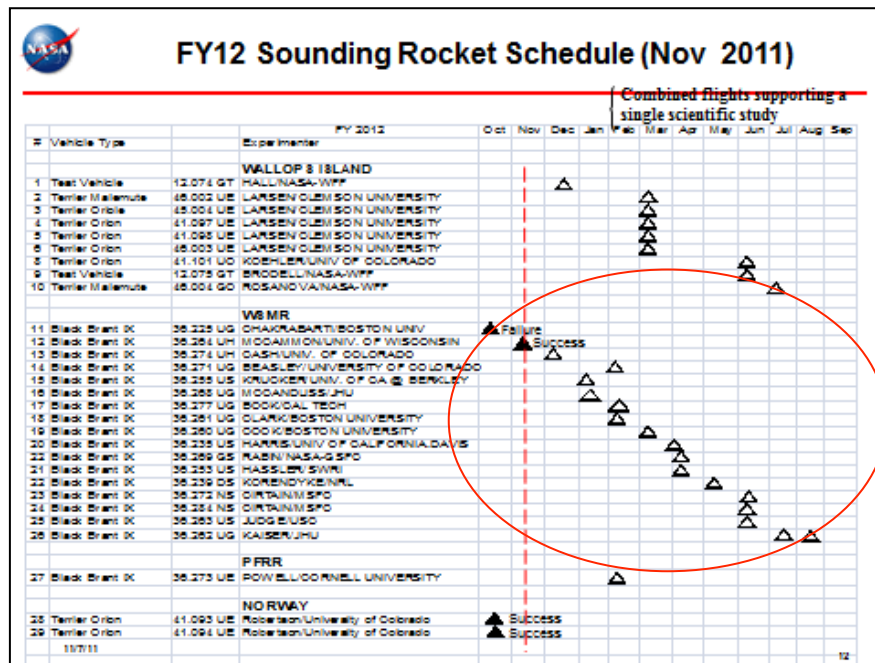
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- Rocket Program
  - 6 science missions (10 rockets), 1 educational mission since last SRWG.
  - 3 educational projects (WRATS, RockOn, RockSat) this summer supports teachers, undergraduate and graduate student teams.
  - Brant Motor technical issues continue to be of concern; SMD/Offices of Chief Engineer and Chief Technologist partnering to consider alternative solutions.
- Balloon Program
  - 12 Missions are Approved by SMD for FY12; 2 Foreign & 3 Domestic Flight Campaigns.
  - High Altitude Student Payload educational mission scheduled for summer Ft Sumner campaign supports 12 student teams. Wallops Balloon Experience for Educators (WBEE) supports 24 teachers for 1-week mission.
- Airborne Science Program
  - Several airborne missions active: IceBridge, Earth Venture CARVE, DC3, MACPEX, etc. SEAC4RS, in planning for 18 months, cancelled for lack of foreign host (Thailand) approval.
  - Student Airborne Research Program: 8-week undergraduate-level summer program June-July supports 32 students, includes lectures, week of science flights, analysis and student presentations.
- CubeSat Program
  - 3<sup>rd</sup> launch opportunity solicitation conducted & 33 cubesats selected
  - SMD Cubesat payload development funded ROSES
- Commercial Flight Opportunities Program
  - 14 technology projects selected by Office of Chief Technologist earlier this month
  - [http://www.nasa.gov/home/hqnews/2012/jul/HQ\\_12-221\\_Suborbital\\_Payloads\\_Selected.html](http://www.nasa.gov/home/hqnews/2012/jul/HQ_12-221_Suborbital_Payloads_Selected.html)



## HQ Discussion Topics

- PI Readiness & Manifest: our ability to catch up from FTS standdown at WSMR has been limited by payload delays (see below). Improved project/schedule management will benefit all.
- Foreign National clearances: early notification essential! NASA HQ has limited silver bullets to get expedited clearances.
- Piggyback Opportunities: accepted on non-interference, no-harm basis only (similar to Cubesat launch opportunity constraints)





**Backup**



## HQ Sounding Rockets Working Group

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- A forum for the SMD divisions to consult on program priorities.
- Helio, Astro, and Planetary Divisions represented. Discipline scientists who fund rocket-based investigations are members, along with the SRPO Program Executive, SRPO Program Manager, and Sounding Rockets Project Scientist.
- Meetings are every 3 months, or as needed.
- The HQ SRWG is used to establish the manifest priorities when resource constraints occur.
  - Factors included in deliberations: PI readiness, discipline priorities, division priorities, directorate balance.
  - PI readiness is assessed by the Program Scientist, based on interviews with the PI and the SRPO program manager & mission manager.